QUANTIFICATION OF A NUISANCE MOSQUITO PROBLEM IN FLORIDA[1]

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For over 50 years mosquito control agencies have attempted to control mosquitoes that create nuisances. This has generally been done without a firm definition of exactly what constitutes a problem. In other words, we do not generally know the threshold of mosquito abundance levels that produce a nuisance. While the object has been to reduce mosquito populations, the level to which they needed to be reduced was unknown. This lack of knowledge has not prevented programs from being successful in controlling nuisance. Generally speaking, mosquito control has measured its success based on the premise that the lower the mosquito population, the better.

While this approach has been successful, it is not necessarily efficient, economical or environmentally sound since it can often lead to over use of insecticides. The consequences of overuse, albeit misuse, of insecticides are well known to us all. Thus, once determined, nuisance threshold levels of mosquitoes could be used as guidelines for 'control' or 'not-to-control' decisions to maximize use of resources.

Two 'rules of thumb' used by control programs to indicate a nuisance problem are a human-baited sweep collection of 5 or more mosquitoes per minute and a bite count of 1 mosquito per 15 minutes (Headlee 1932). Headlee used the 1 bite per 15 minute threshold which he established "by experience" to develop an equivalent threshold of 24 mosquitoes per night in a New Jersey light trap collection. While this is certainly the type of information required, there is no quantitative data in the scientific literature that establishes a link between any of these thresholds and a nuisance problem. The methods Headlee used to develop the threshold are, without question, invalid. For example, he used only four observations.

Unfortunately, the 24 mosquitoes per night threshold was still being used in 1983 (Robinson and Atkins 1983) and presumably is still being used today. Acceptance of these unsubstantiated thresholds proposed by classical mosquito control workers has had a dampening effect on research into the relationships between mosquito populations and nuisance problems. There is essentially no scientific literature on the subject.

In an attempt to change this, we began a series of studies in 1986 to examine the relationships between service requests and mosquito populations. As part of those studies we conducted a survey of residents in two south Florida counties to determine quantitatively what the general public considers a nuisance mosquito problem.

Between July 27, 1986 and July 30, 1987, a survey form concerning mosquitoes was sent whenever possible to each person who called to request mosquito control services from Polk County or Sarasota County mosquito control programs. During the same time period, and within a week of the calls, a similar survey form was hand-distributed to neighbors of the person who called. Other than knowing that they had not called to request mosquito control service since July 27, 1986, the call-in history of the neighbors was unknown when the forms were distributed.

The survey contained questions related to mosquito problems in their neighborhood, their local mosquito control program, and their desires for and personal approaches to mosquito control. The answers to a series of other questions collectively provided a personal profile of the respondent. In this report we address only the responses to the questions which quantified their opinions of what constitutes a nuisance mosquito problem and how these opinions related to age and sex.

Three questions in the survey contained the following hypothetical situation:

> If you sat on your porch and were bothered by mosquitoes once about every —— minutes (or seconds), how bad would you describe this problem to be on a scale from 1 to 5, where 1 is "No problem", 2 is a "Slight" problem, 3 is a "Moderate" problem, 4 is a "Bad" problem and 5 is a "Very Bad" problem?

The 'time' indicated in the blank differed for the three questions in each survey. For each survey, one 'time' was taken from each of the three following groups: group A: 30, 20 and 15 minutes; group B: 10, 5 and 1 minute; and group C: 30, 15 and 15 seconds.

Survey results were recorded and analyzed on an IBM PC XT computer using ANOVA and CROSSTABS statistical procedures of SPSSPC+.

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In Polk County, 1,095 survey forms were distributed; 703 to people requesting service and 392 to non-service requesting neighbors. We received 495 (70.4%) completed forms from requesters and 187 (47.7%) completed forms from non-requesters. In Sarasota County, 157 requesters and 118 non-requesters, out of an unknown number distributed, returned completed forms. The number of forms returned for each 'time' ranged from 130–146 for Polk requesters, 47–54 for Polk non-requesters, 42–46 for Sarasota requesters and 24–38 for Sarasota non-requesters.

There were significant differences between the sex ratios, but not the age frequency distributions, of requesters and nonrequesters in both counties (Table 1). There were equal numbers of males and females among the requesters but twice as many males among the non-requesters. This was undoubtedly due to the difference in the way the forms were distributed. The requesters were mailed forms addressed to the individual that called and presumably it was the addressee who completed and returned the form. The 50/50 sex ratio for the requesters suggests that males and females call with approximately equal frequency. The nonrequester forms left at the neighbors' homes were not addressed. These were apparently filled out and returned primarily by our society's traditional "head of the household," the man. Therefore, to correct for this sex difference our non-requester data was weighted by sex before analysis. It is interesting that Gerhardt et al. (1973) had a similar difference in sex ratios between an interview survey and a mail survey of biting fly problems in North Carolina.

There were no consistent differences between the frequency distributions (Chi-Square $P < 0.05$) or means (ANOVA $P < 0.05$) of responses of males and females, among different age groups, or between requesters and non-requesters for each of the 9 'times' in either county. Therefore, the data for requesters and non-requester were combined prior to comparing the responses between counties.

In both counties there was a continual increase in the indicated mosquito problem from attack rates of 1 per 30 minutes to 1 per 30 seconds (Fig. 1). Over this range the indicated problem changed from "Slight/Moderate" at the low end to its peak near the "Very Bad" level. Attack rates more frequent than 1 per 30 seconds did not substantially increase the problem rating. In Polk County only, attack rates less than 1 per 15 minutes did not substantially reduce the indicated mosquito problem.

Even at an attack rate of 1 every 30 minutes, the average person in both counties thought there was more than a "Slight" mosquito problem. On the average, people thought there was a "Moderate" mosquito problem at 1 attack about every 12 minutes and a "Bad" mosquito problem at 1 attack about every minute. This "Bad" problem index is 1/5th the rate of the rule of thumb rate of 5 'bites' per minute mentioned earlier. This rule of thumb seems to be a very conservative estimate of the threshold of a nuisance problem. Our results tend to support the 56 year old opinion of Headlee (1932) that "... when a human collector can take an average of more than one mosquito in fifteen minutes,

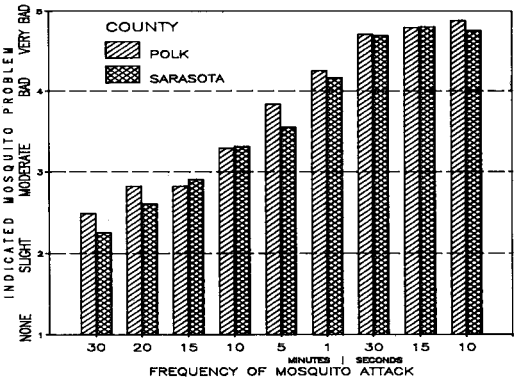

Fig. 1. Quantification of a nuisance mosquito problem by Polk and Sarasota County, Florida residents.

Table 1. Number of survey forms returned indicating sex and/or age group of person that completed the form.

	Polk County				Sarasota County			
	Requesters		Nonrequesters		Requesters		Nonrequesters	
	No.	%	No.	%	No.	%	No.	%
Sex								
Females	227	47.1	62	34.6	76	49.0	78	66.7
Males	255	52.9	117	65.4	79	51.0	39	33.3
Total	482		179		155		117	
Age								
20–39	141	34.4	42	27.8	52	38.2	37	36.3
40–59	64	15.6	35	23.2	23	16.9	16	15.7
60–89	205	50.0	74	49.0	61	44.9	49	48.0
Total	410		151		136		102	

the density is sufficient to give the householder trouble."

It is clear that residents in general, regardless of sex, age, or whether or not they called to request mosquito control services, thought that mosquitoes became a problem at similar attack frequencies. This was true in a coastal Florida county (Sarasota), where most mosquito problems are caused by diurnal host seeking *Aedes taeniorhynchus* (Wied.) and *Aedes aegypti* (Linn.), as well as in an inland Florida county (Polk) where most mosquito problems are caused by the crepuscular activity of *Anopheles crucians* Wied., *Coquillettidia perturbans* (Walker), *Mansonia* and *Culex salinarius* Coquillett. Gerhardt et al. (1973) also found no relationships between either sex or age of North Carolina respondents and the frequencies of their being irritated by biting flies.

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